



Simulation of Two-Phase Flow in an Oil Reservoir using Adaptive High-Order Runge-Kutta based Time-Integration

Völcker, Carsten; Jørgensen, John Bagterp; Thomsen, Per Grove; Stenby, Erling Halfdan

Publication date:
2009

Document Version
Publisher's PDF, also known as Version of record

[Link back to DTU Orbit](#)

Citation (APA):
Völcker, C., Jørgensen, J. B., Thomsen, P. G., & Stenby, E. H. (2009). *Simulation of Two-Phase Flow in an Oil Reservoir using Adaptive High-Order Runge-Kutta based Time-Integration*. Abstract from 15th Nordic Process Control Workshop, Porsgrunn, Norway.

General rights

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Simulation of Two-Phase Flow in an Oil Reservoir using Adaptive High-Order Runge-Kutta based Time-Integration

Carsten Völcker, John Bagterp Jørgensen, Per Grove Thomsen

*Department of Informatics and Mathematical Modeling
Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark*

Erling H. Stenby

*Department of Chemical and Biochemical Engineering
Technical University of Denmark, DK-2800 Kgs. Lyngby, Denmark*

Keywords : Oil Reservoir Simulation, Runge-Kutta Methods, Optimal Control, Nonlinear Model Predictive Control, Computational Methods

Off-shore subsurface oil fields are porous rocks with oil trapped in the pores. Conventional technologies for recovery of this oil in porous rocks leave more than 50% of the oil in the reservoir. Wells with adjustable downhole flow control devices coupled with modern control technology offer the potential to increase the oil recovery significantly. The valve settings could be computed by solution of a large scale constrained optimal control problem implemented in a receding horizon fashion. The major computational effort in this optimal control problem concerns solution of a very large system of differential equations describing the flow of oil and water in the porous rock. We present a two-phase immiscible flow model for the oil reservoir and describe a new explicit singly diagonally implicit Runge-Kutta (ESDIRK) method for computationally efficient solution of this model. The ESDIRK integrator is mass preserving, of high order, and equipped with integration error control. The ESDIRK methods are computationally competitive to the implicit Euler method normally used for solution of the oil reservoir two phase immiscible flow problem.

Acknowledgement

This research project is funded by the Danish Research Council for Technology and Production Sciences. FTP Grant no. 274-06-0284